Implications of outdoor recreation for wildlife conservation in protected areas

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Outline

- Introduction
- Literature review (M.S. chapter 1)

  - questions?
- Field study of recreation (M.S. chapter 2)

  - questions?
- Plans for Ph.D. project

  - questions, feedback

Recreation is diverse and growing

Visitor days (U.S.)

↑ 32.5%

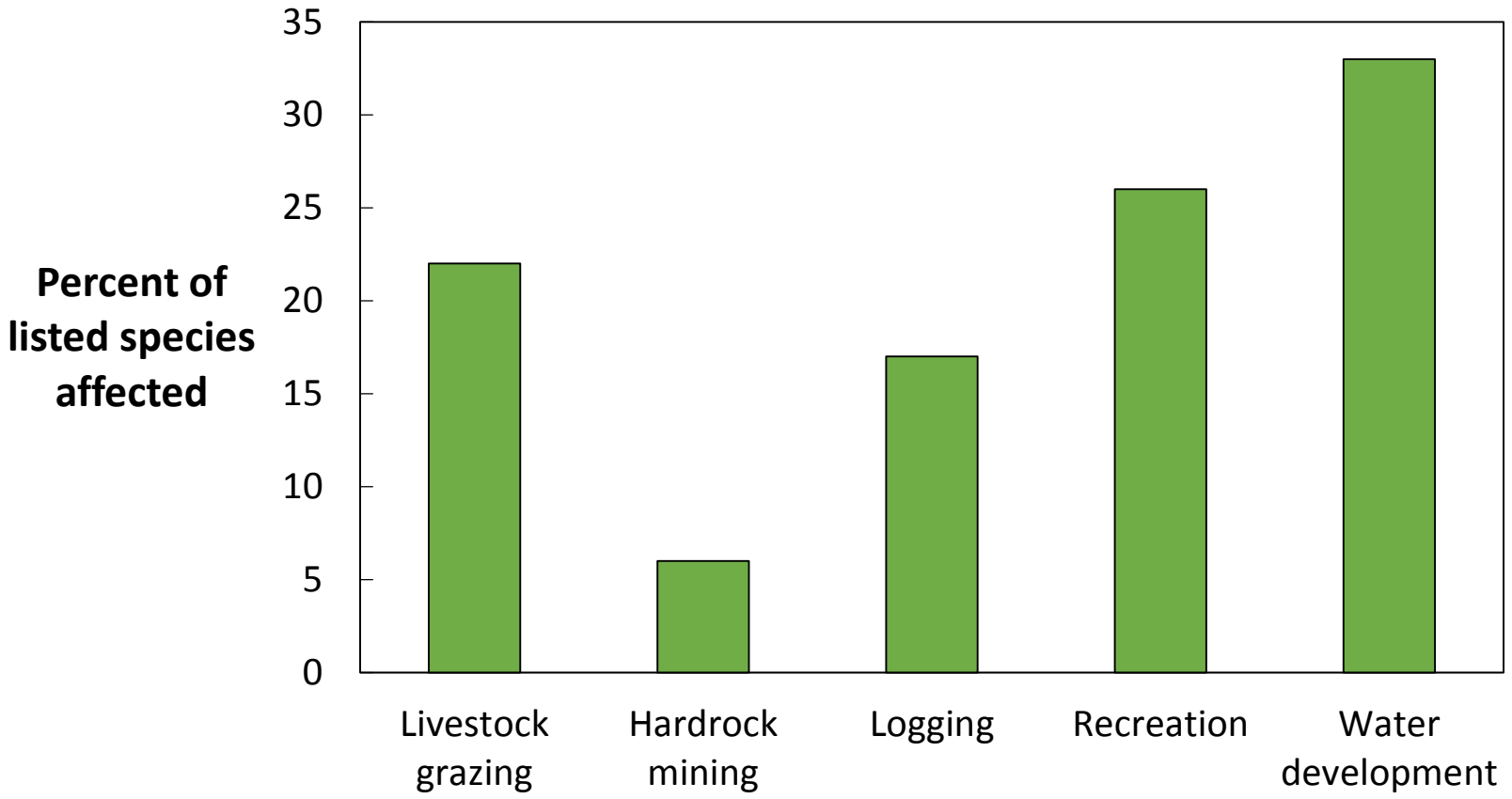
2000 - 2009

GEOCACHING.COM

KEEP CALM AND GO GEOCACHING

Recreation is common in protected areas

Is recreation a problem?



Re-created from Losos et al. 1995

Recreation effects on wildlife

Community: species richness, diversity, community composition

Population: survival, reproduction, abundance, density, distribution

Individual: behavior, physiology

Literature review questions

1. When, where have studies been published?
2. What has been studied?
3. What impacts have been found?
4. What can be done?

Article selection process

JOURNALS

Categories:
Biodiversity conservation
Ecology
Zoology
Behavioral sciences

316 journals

Criteria:
Reasonable subject
Language

165 journals

PAPERS

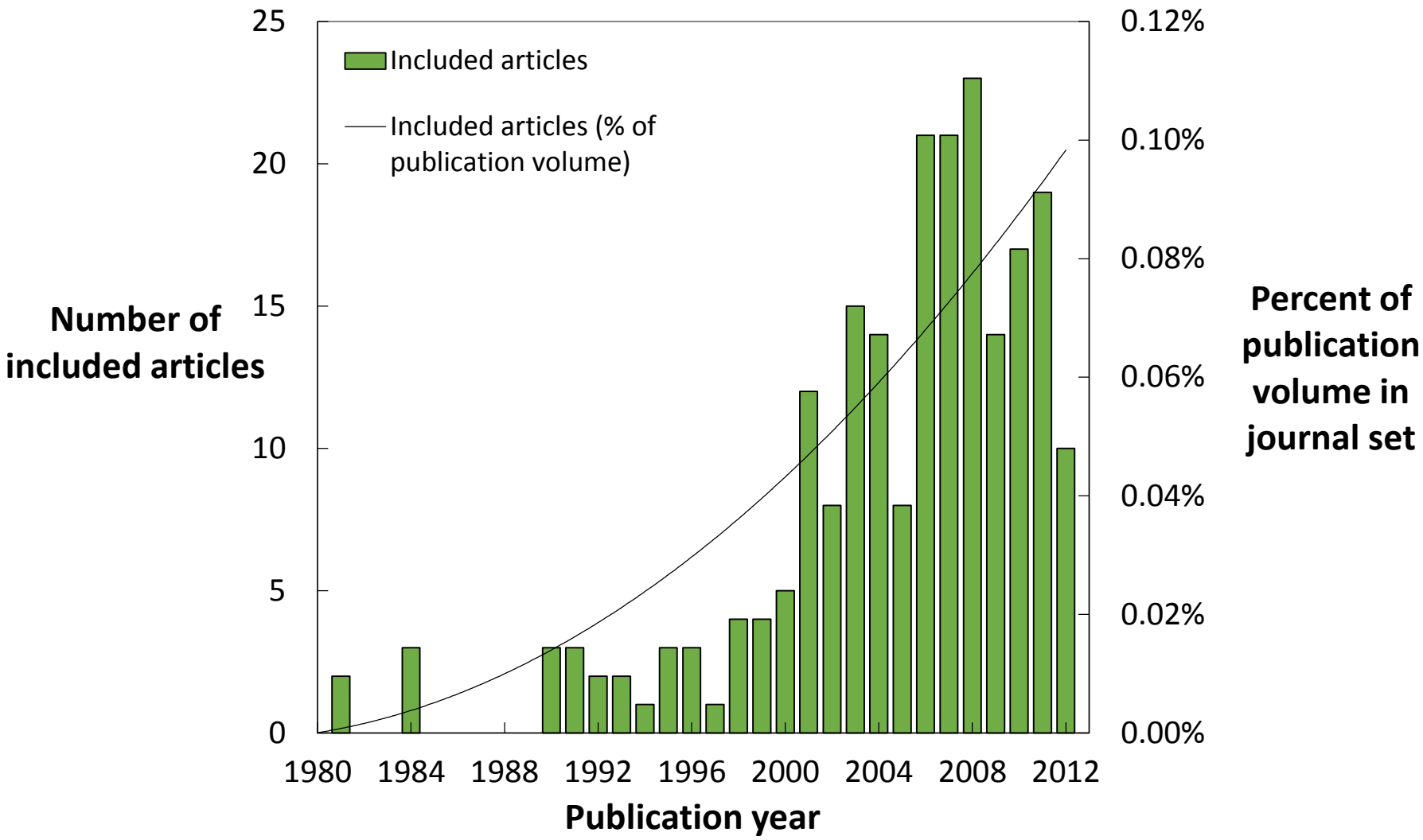
Web of Science search:
Recreat* or touris*

~1700 papers

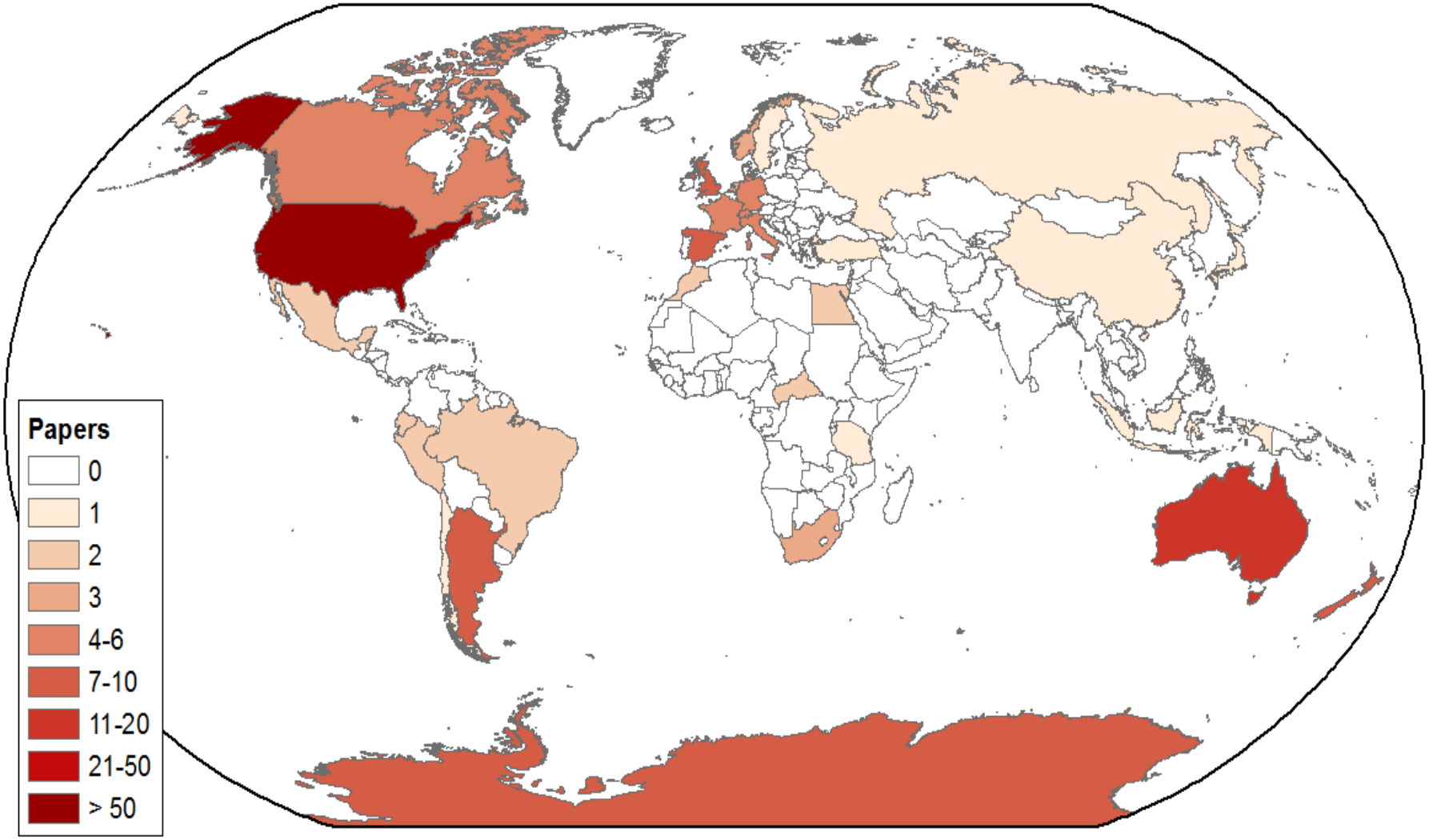
Criteria:
1+ animal species
Non-consumptive
Empirical
Activity, not infrastructure
Not invasive sp. / disease

218 papers

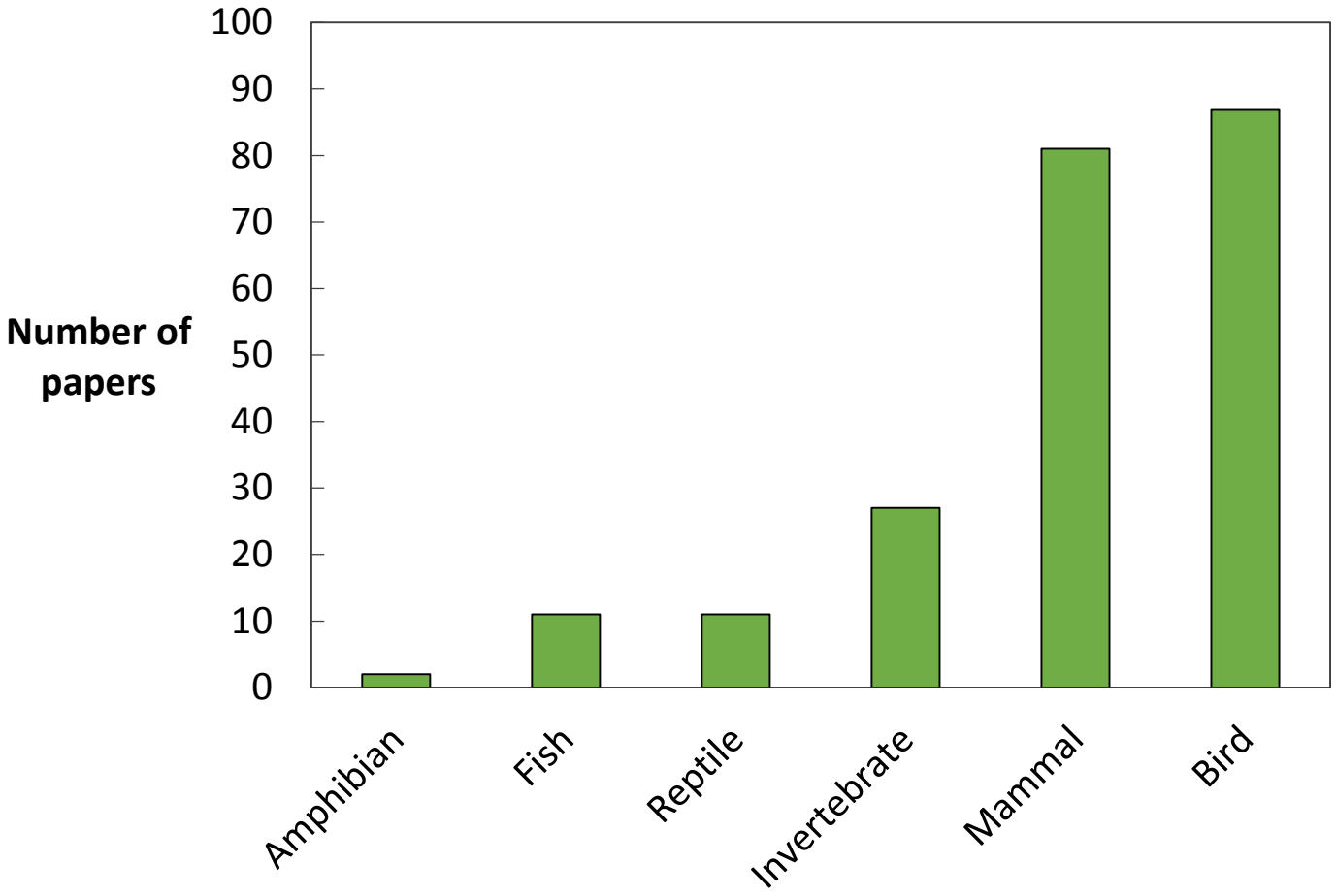
Number of studies is growing



Biased geographic focus

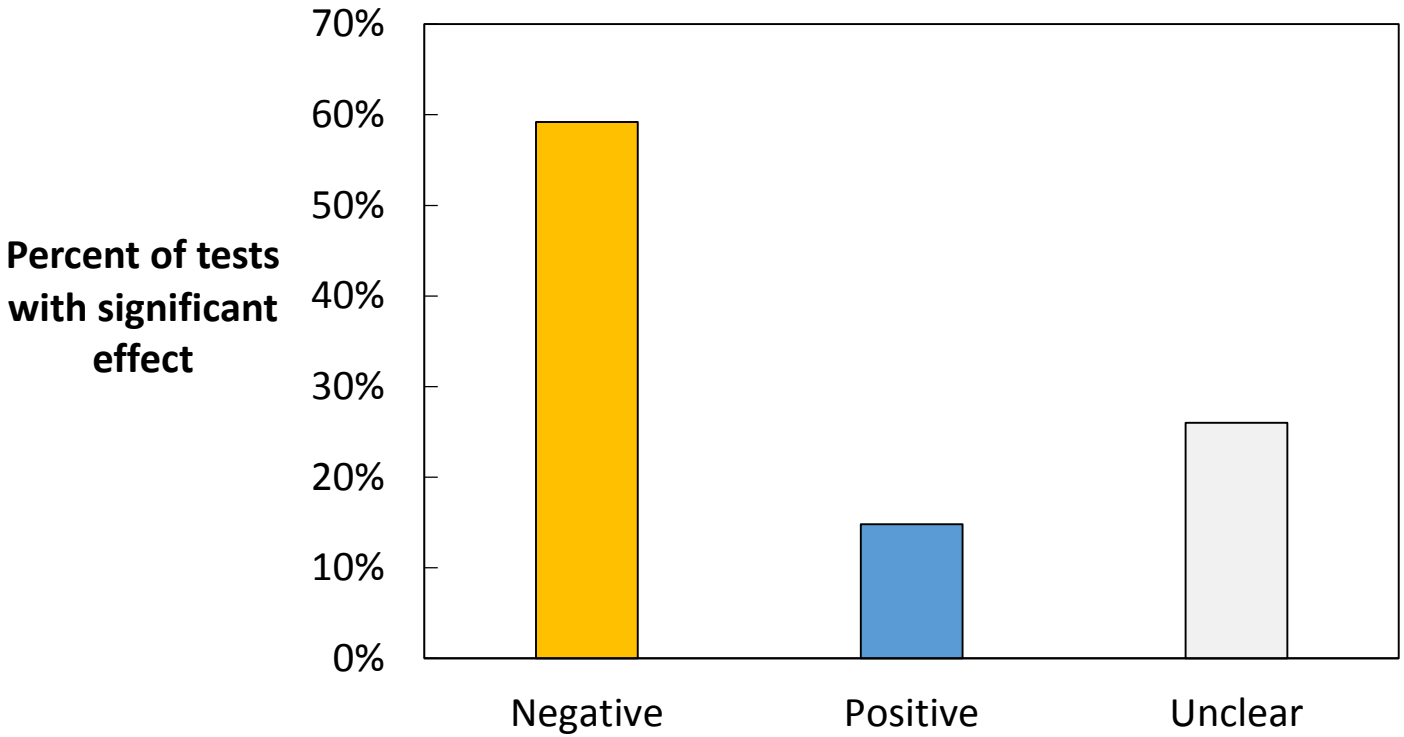


Biased taxonomic focus

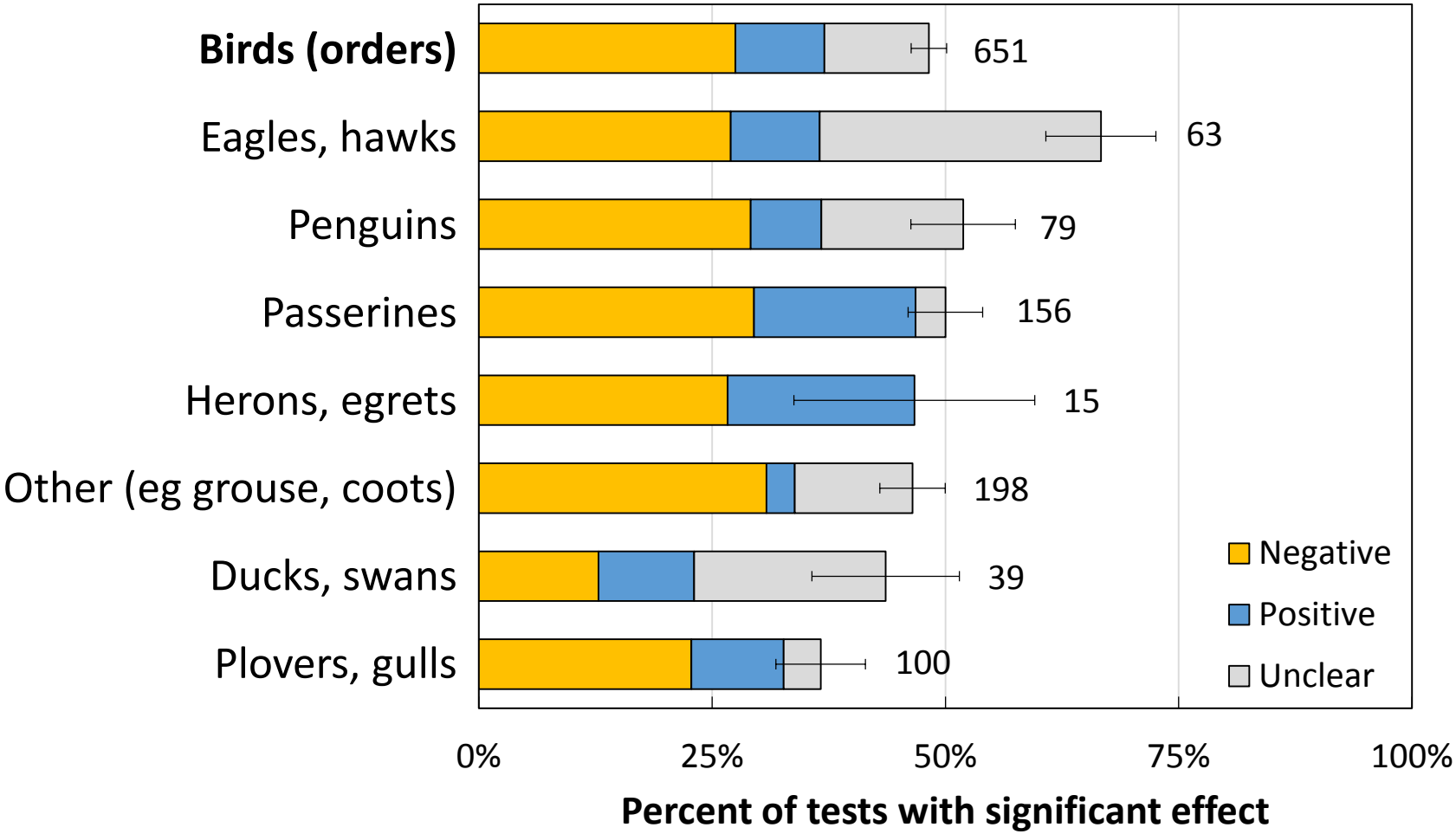


Evidence for overall recreation effects

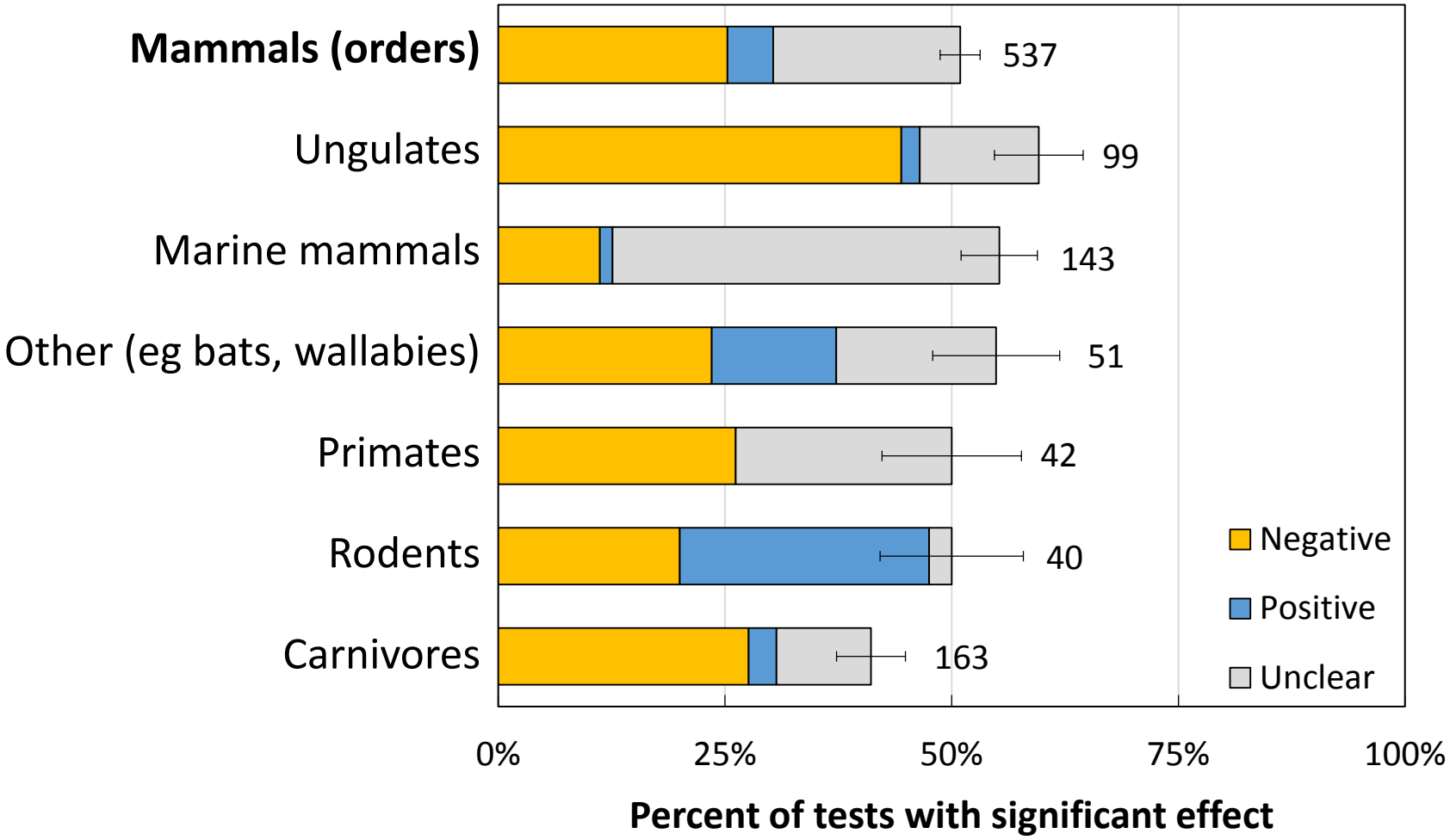
At least one significant effect in 93% of articles



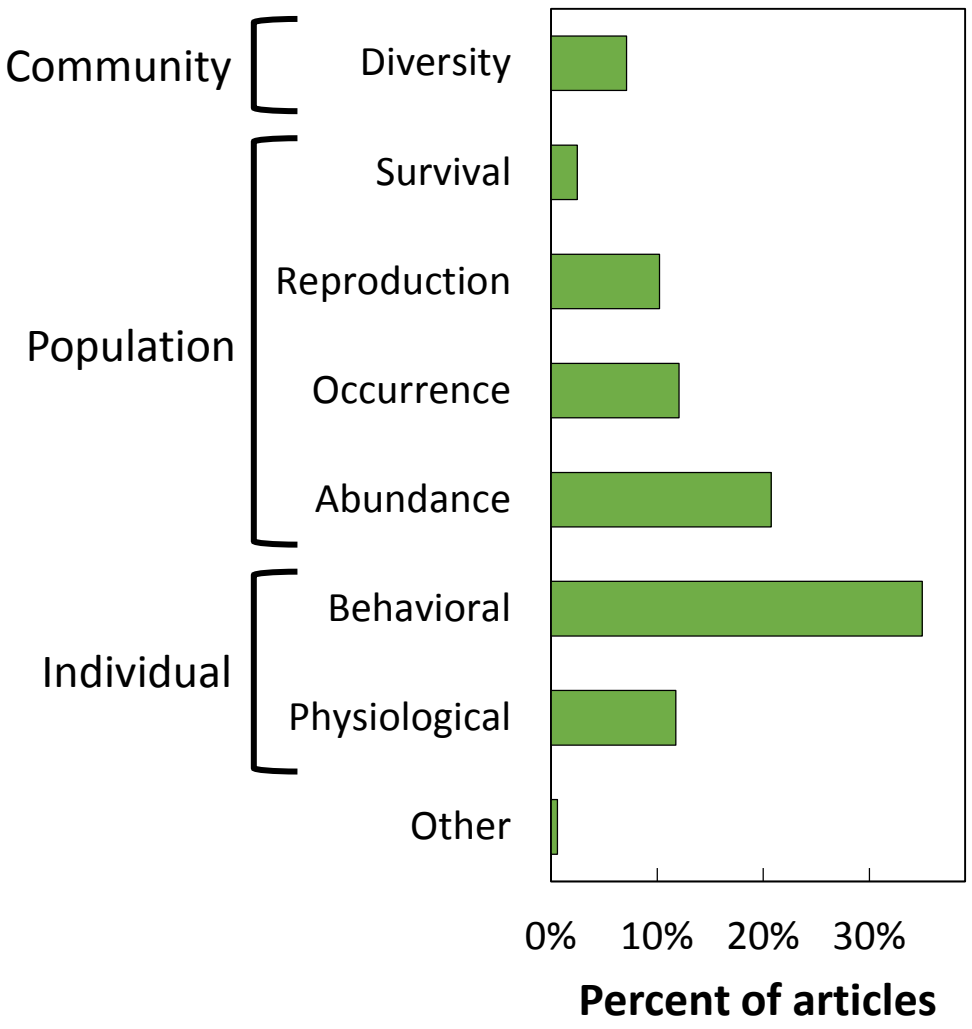
Evidence for recreation effect: birds



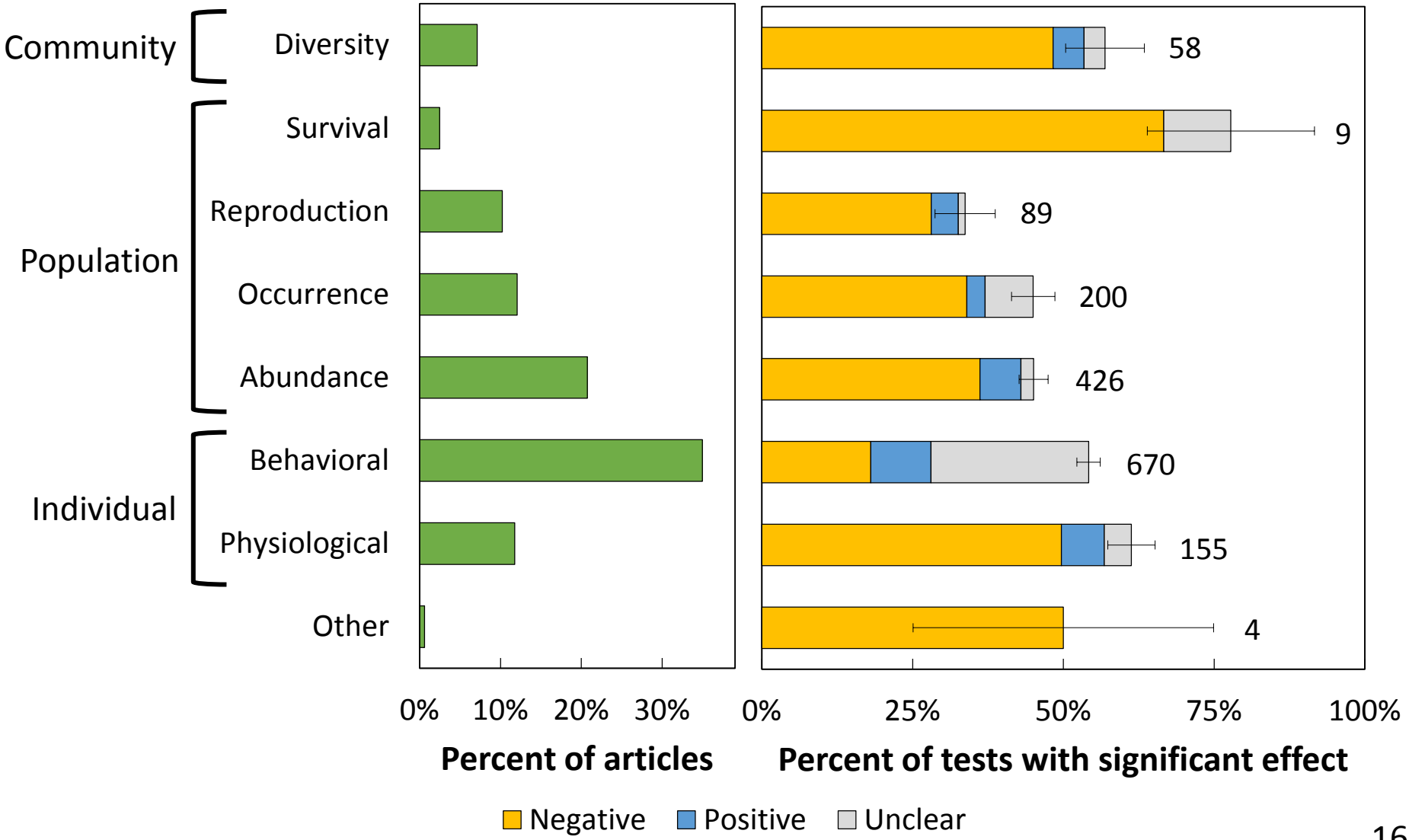
Evidence for recreation effect: mammals



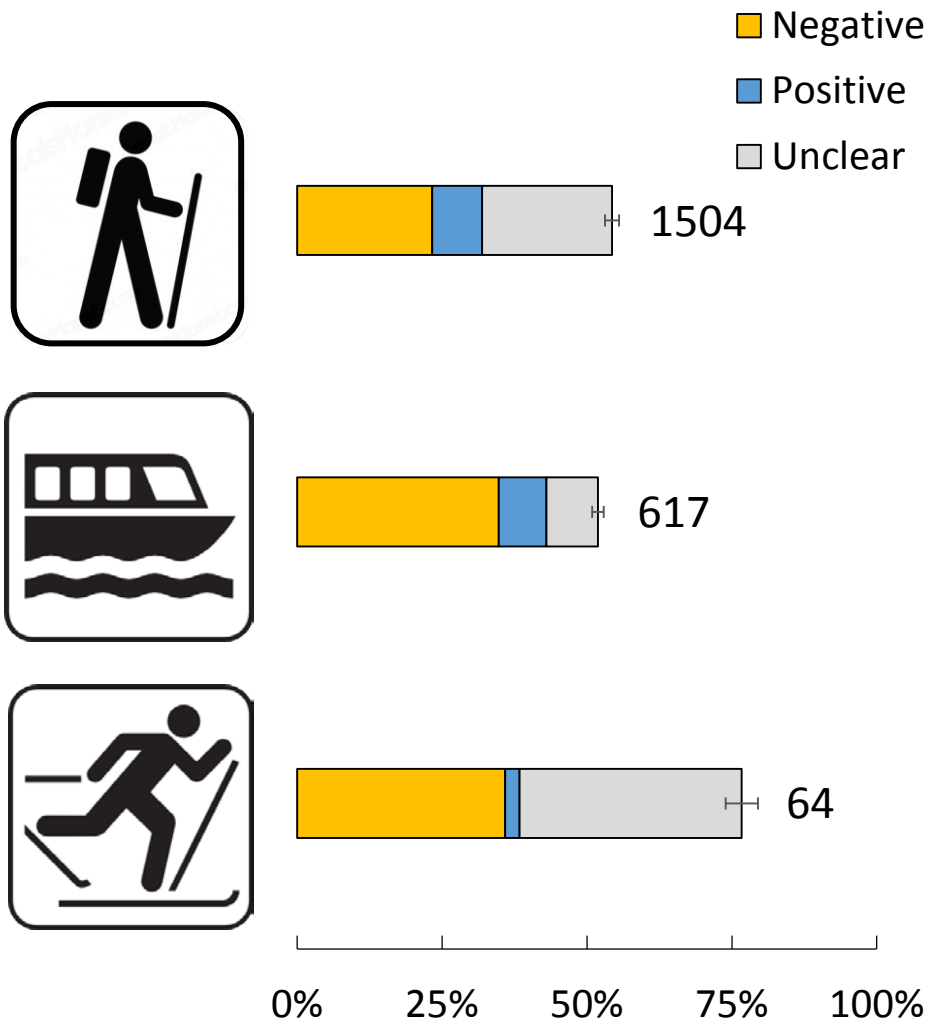
Response types differed in impact



Response types differed in impact



Recreation activities differed in impact



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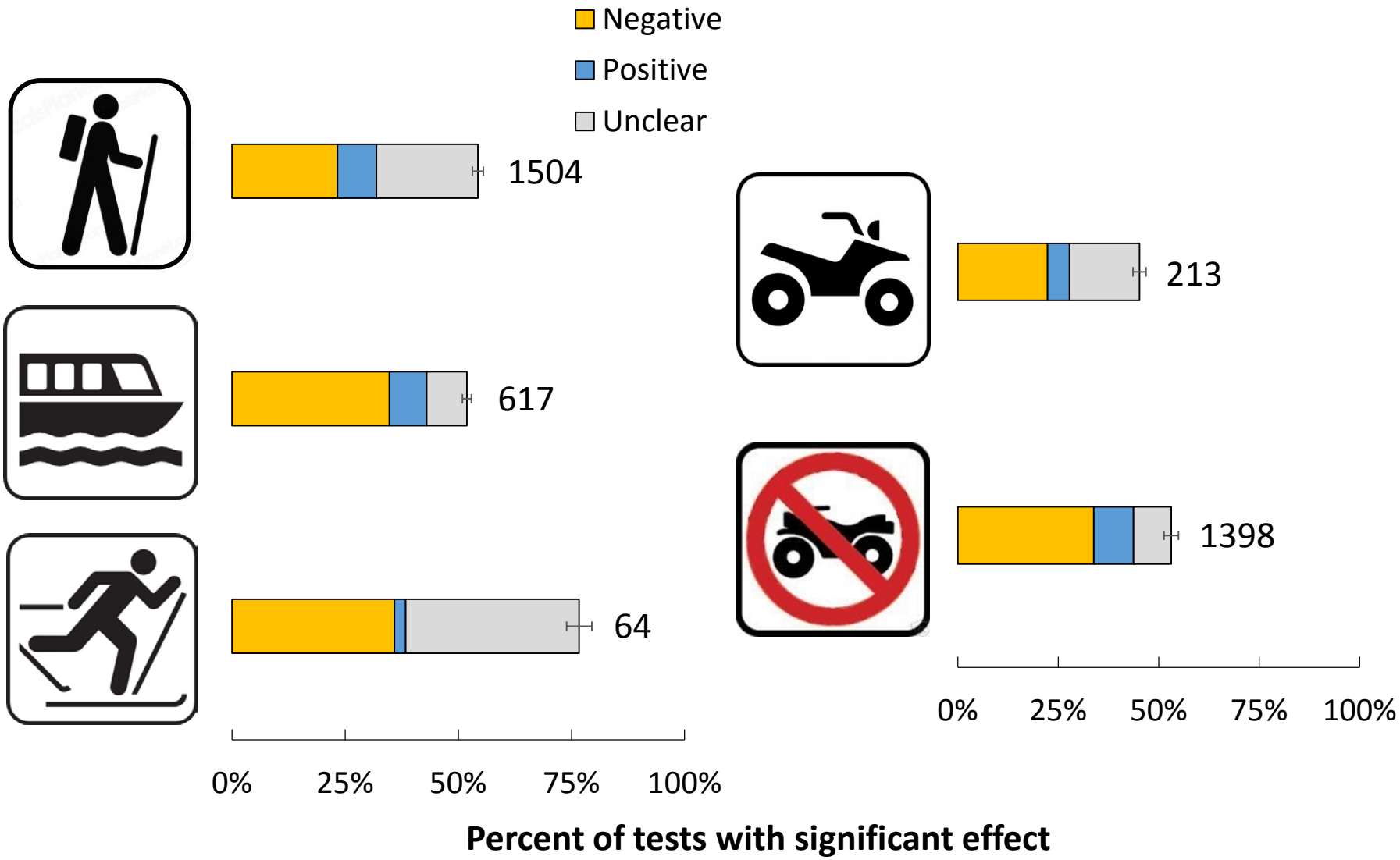


Management recommendations

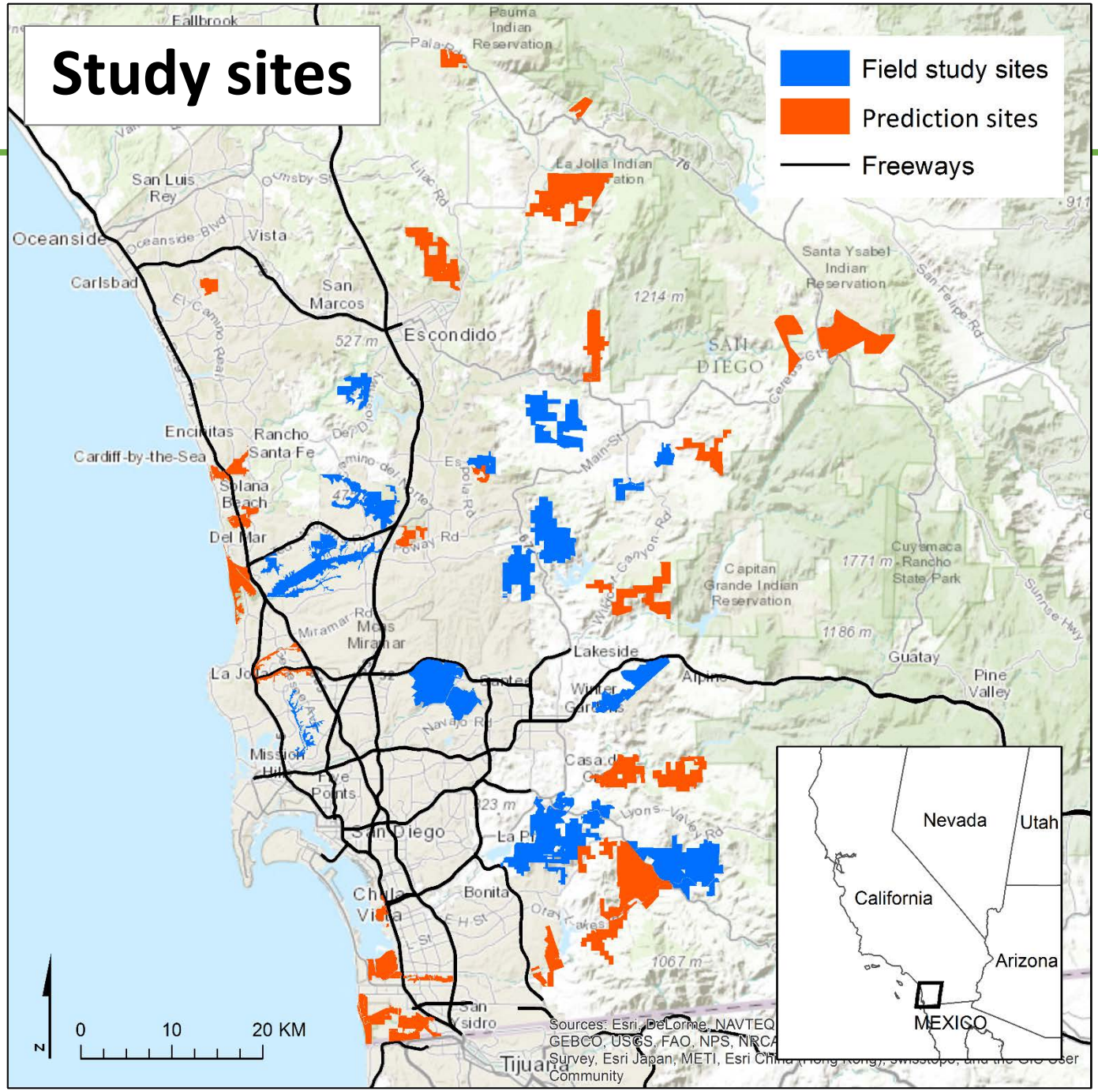
- None (35.2%)
- Spatial restrictions (29.2%)
- Capping visitation (14.6%)
- Visitor education (13.0%)
- Temporal restrictions (11.3%)
- Physical improvements (8.5%)
- Rule change (8.1%)
- Enforcement of rules (6.1%)

Questions?

Goals for field study

1. Measure recreational use across a network of reserves
2. Identify important factors for explaining variation in use
3. Develop predictive model of recreation
4. Examine exposure of wildlife to recreation

Study sites


Field study sites
Prediction sites
Freeways
Fallbrook
Pauma Indian Reservation
La Jolla Indian
San Luis Rey
Oceanside
Vista
Carlsbad
San Marcos
Escondido
Santa Ysabel Indian Reservation
SAN DIEGO
Encinitas
Rancho Santa Fe
Cardiff-by-the-Sea
Solana Beach
Del Mar
Capitan Grande Indian Reservation
Cuyamaca Rancho State Park
Lakeside
Guatay
Pine Valley
Mission Hills
Point Loma
San Diego
Chula Vista
Bonita
Tijuana
0
10
20 KM
N
Nevada
Utah
California
Arizona
MEXICO
Sources: Esri, DeLorme, NAVTEQ, GEBCO, USGS, FAO, NPS, NRCA
Survey, Esri Japan, METI, Esri China (Hong Kong), Swisstopo, and the GIS User Community

Estimation method 1: Survey

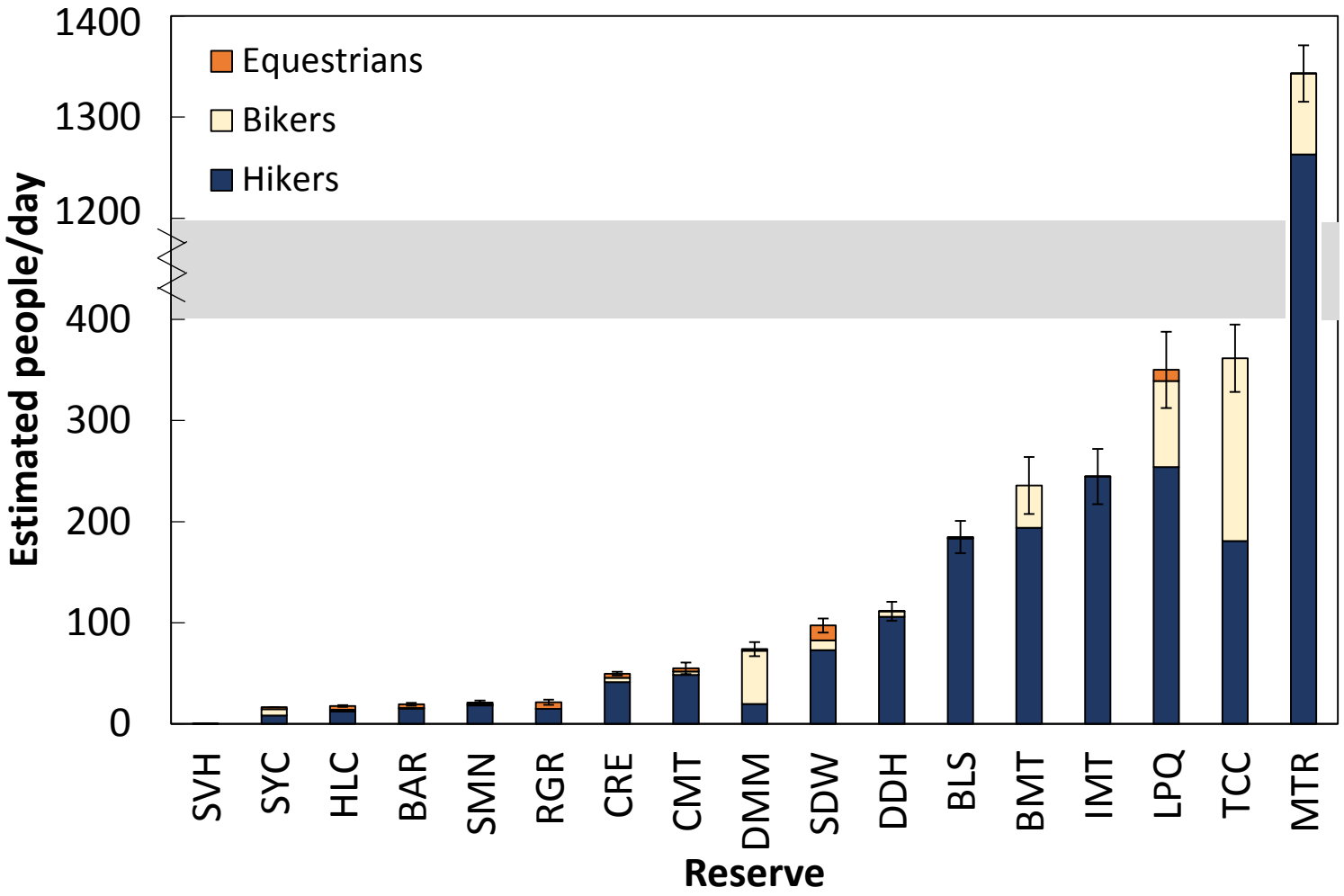
4. What types of recreation occur at the reserve(s) on an average weekday? Please type in your estimate of the level of use using the following scale:
1 = very low; 10 or fewer people per day
2 = low; 10-49 people per day
3 = moderate; 50-199 people per day
4 = high; 200 - 499 people per day
5 = very high; 500 or more people per day

	Hiking	Biking	Horseback riding	Dog-walking	Off-highway vehicles	Other (please specify in Comments)
Iron Mountain						
Mission Trails Regional Park						
Hellhole Canyon Preserve						

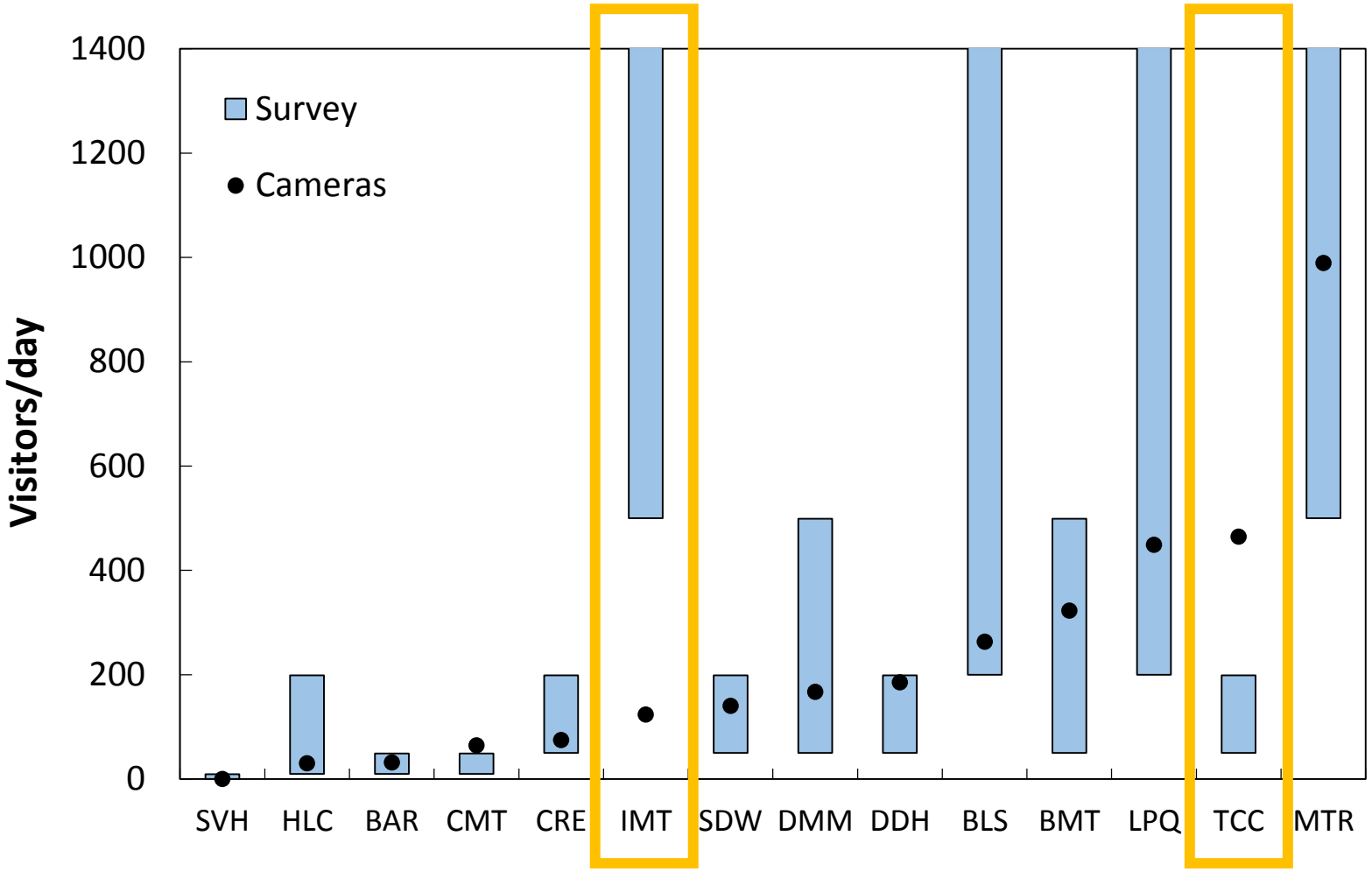
Estimation method 2: Camera traps

- Camera traps at reserve entrances
- 14-day sampling periods
- July – October 2013

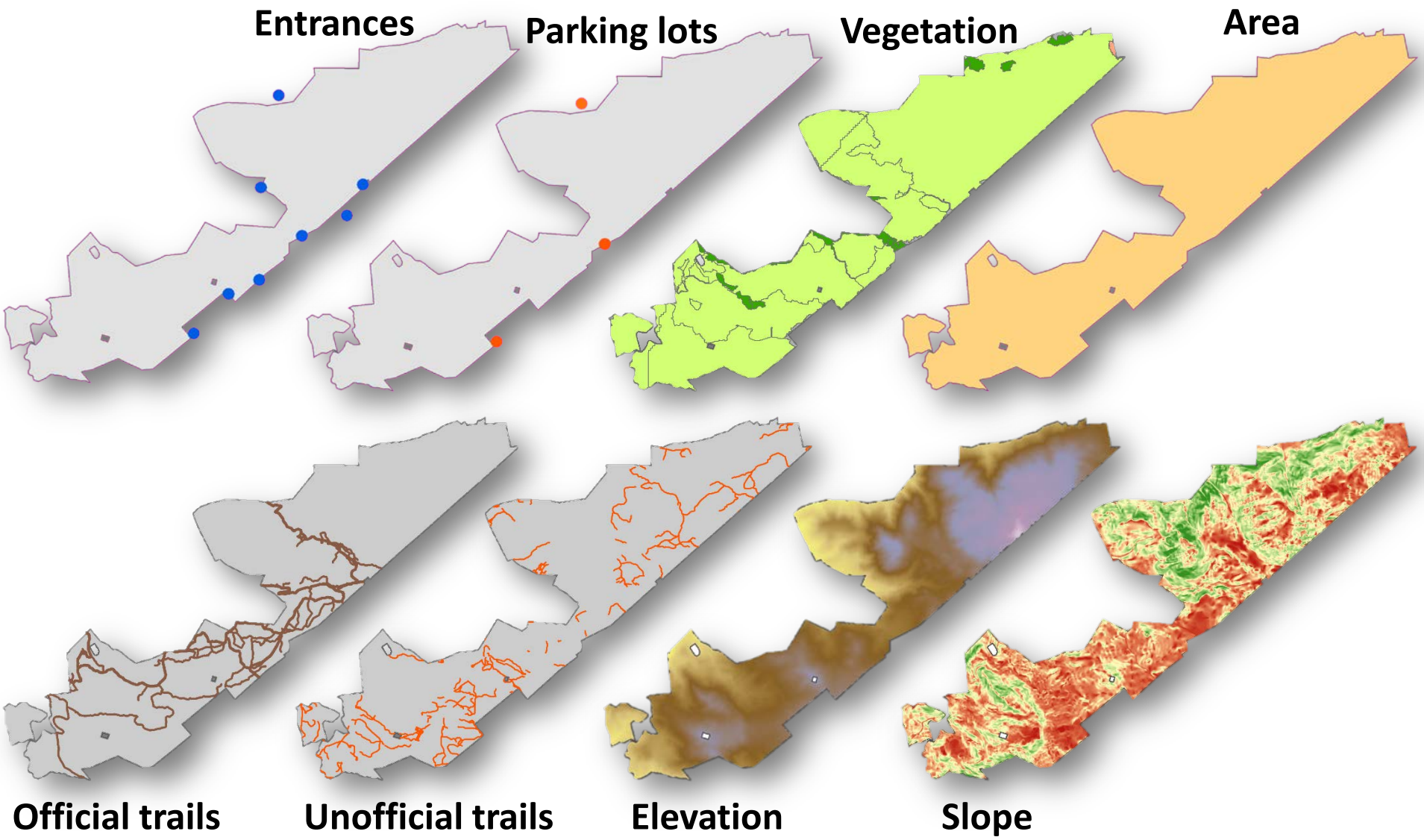
Level of recreation was variable



Survey and camera estimates were similar



Predictor variables: reserve-level



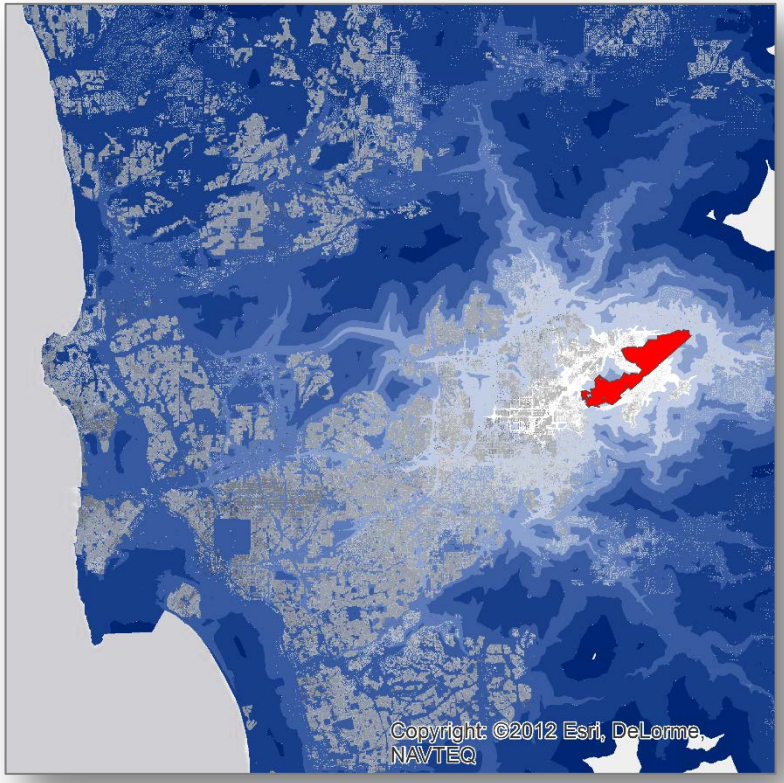
Predictor variables: landscape-level

Distance from coast

Predictor variables: landscape-level

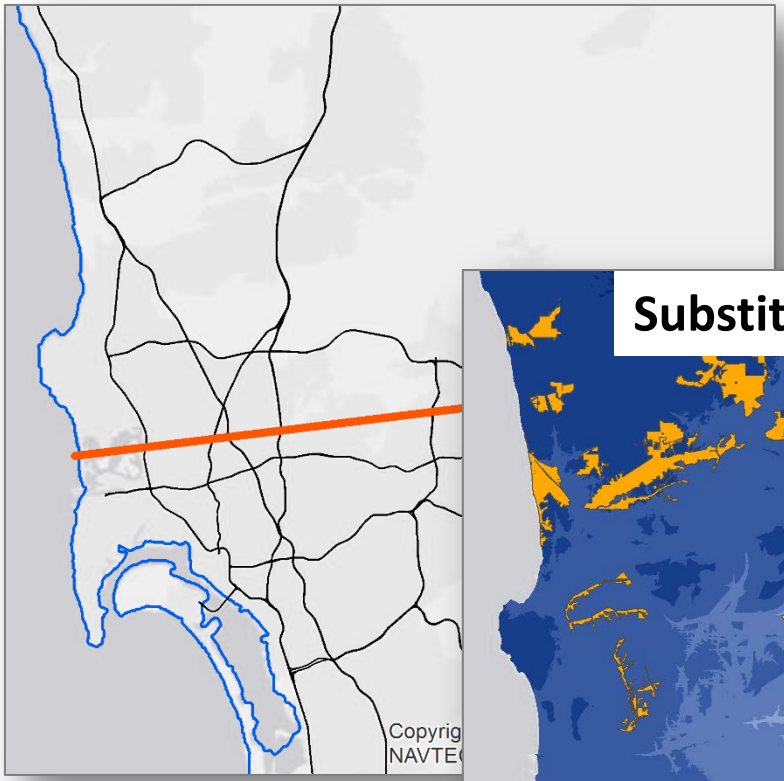
Distance from coast

Housing units

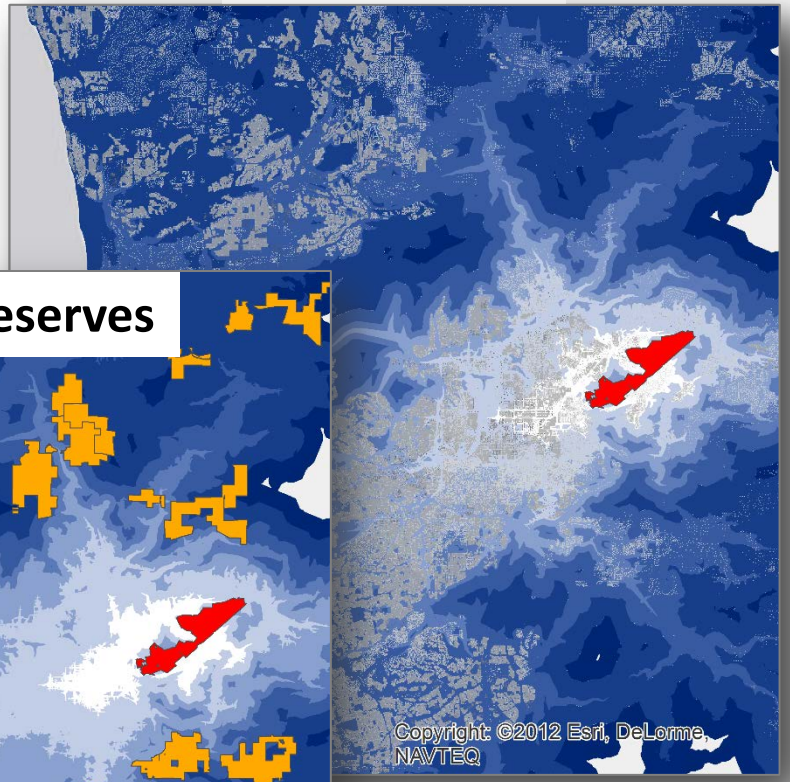


Predictor variables: landscape-level

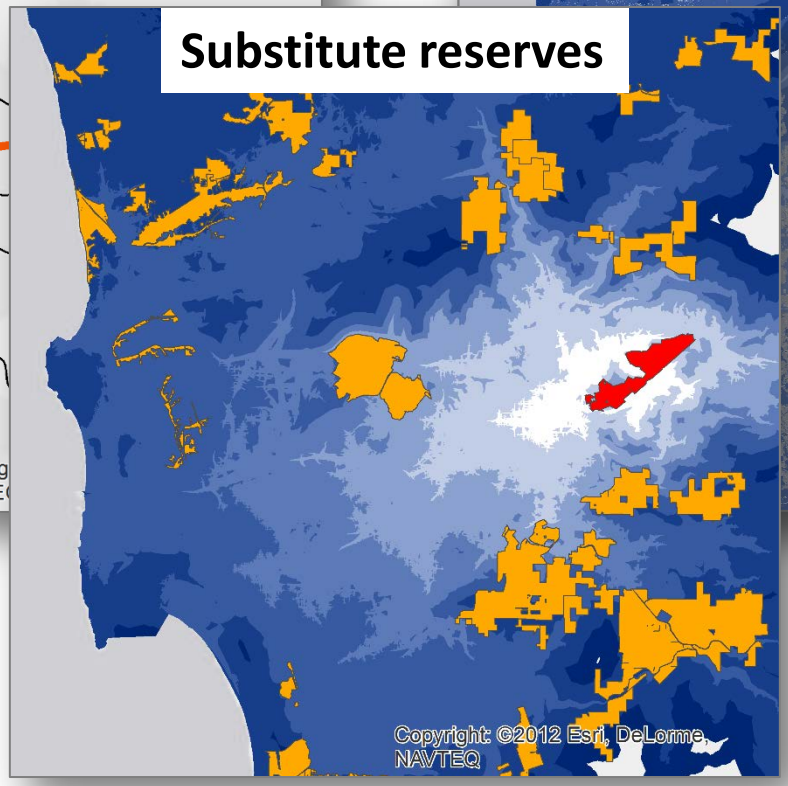
Distance from coast



Housing units

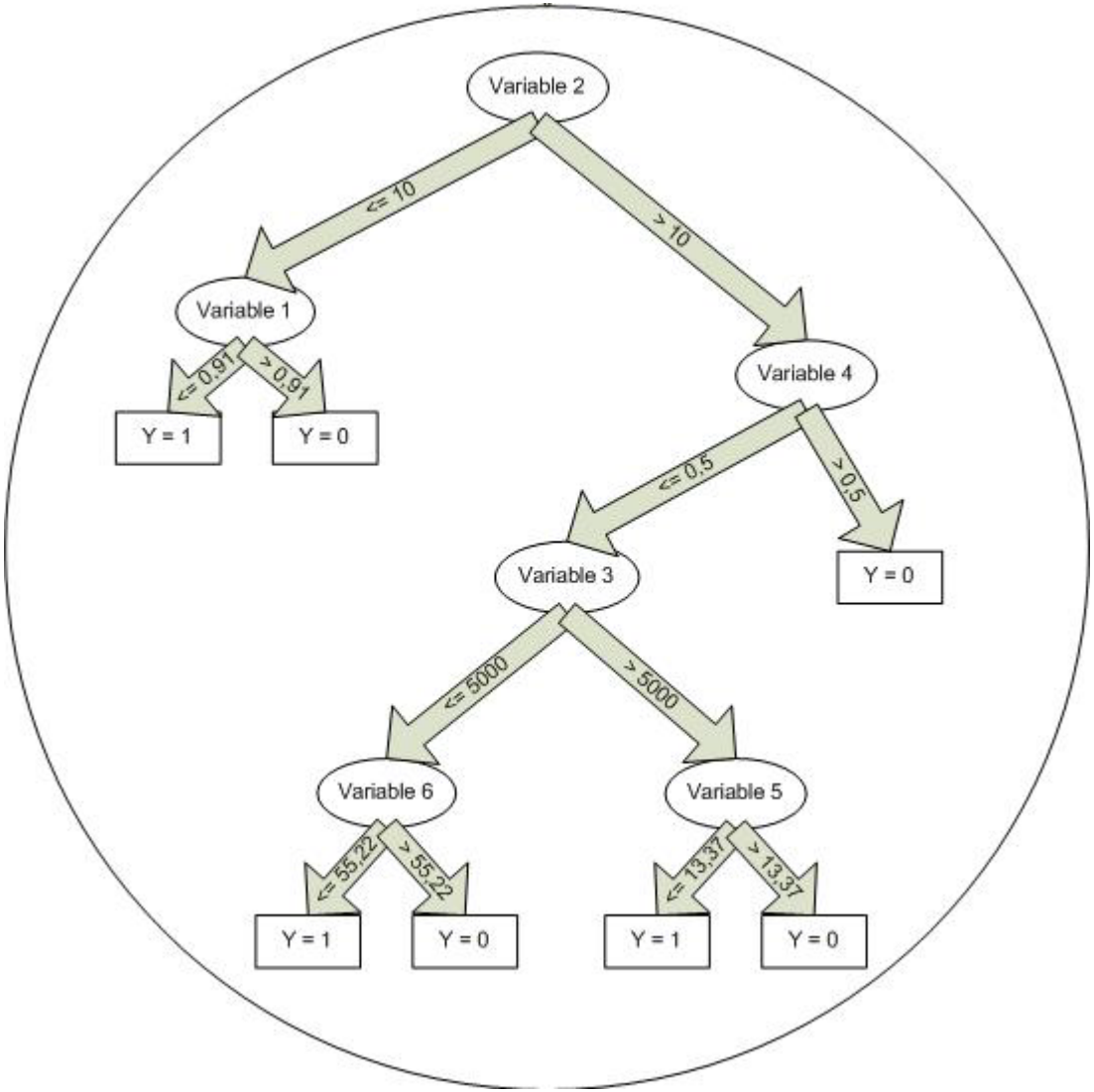


Substitute reserves

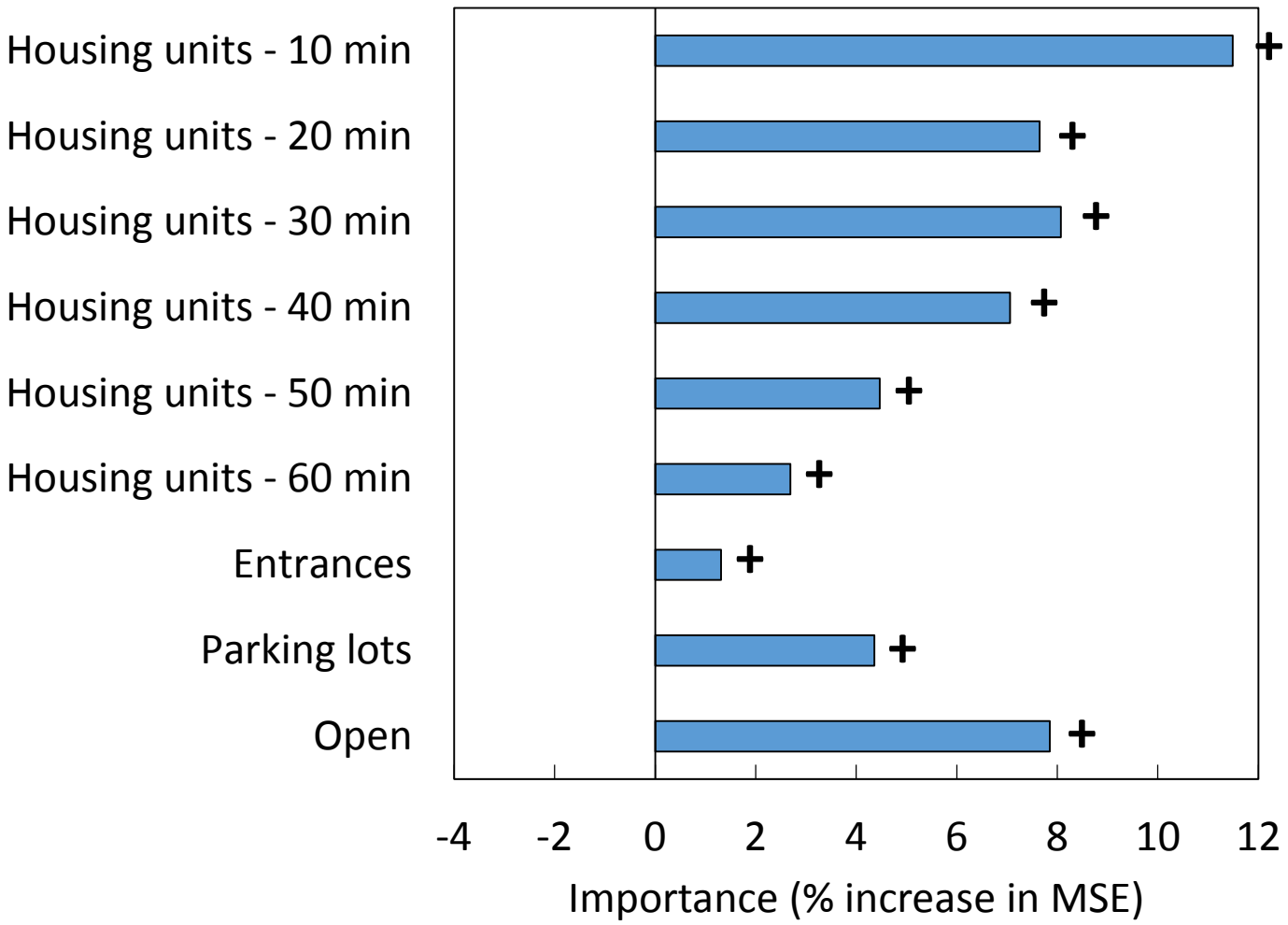


Random forest models

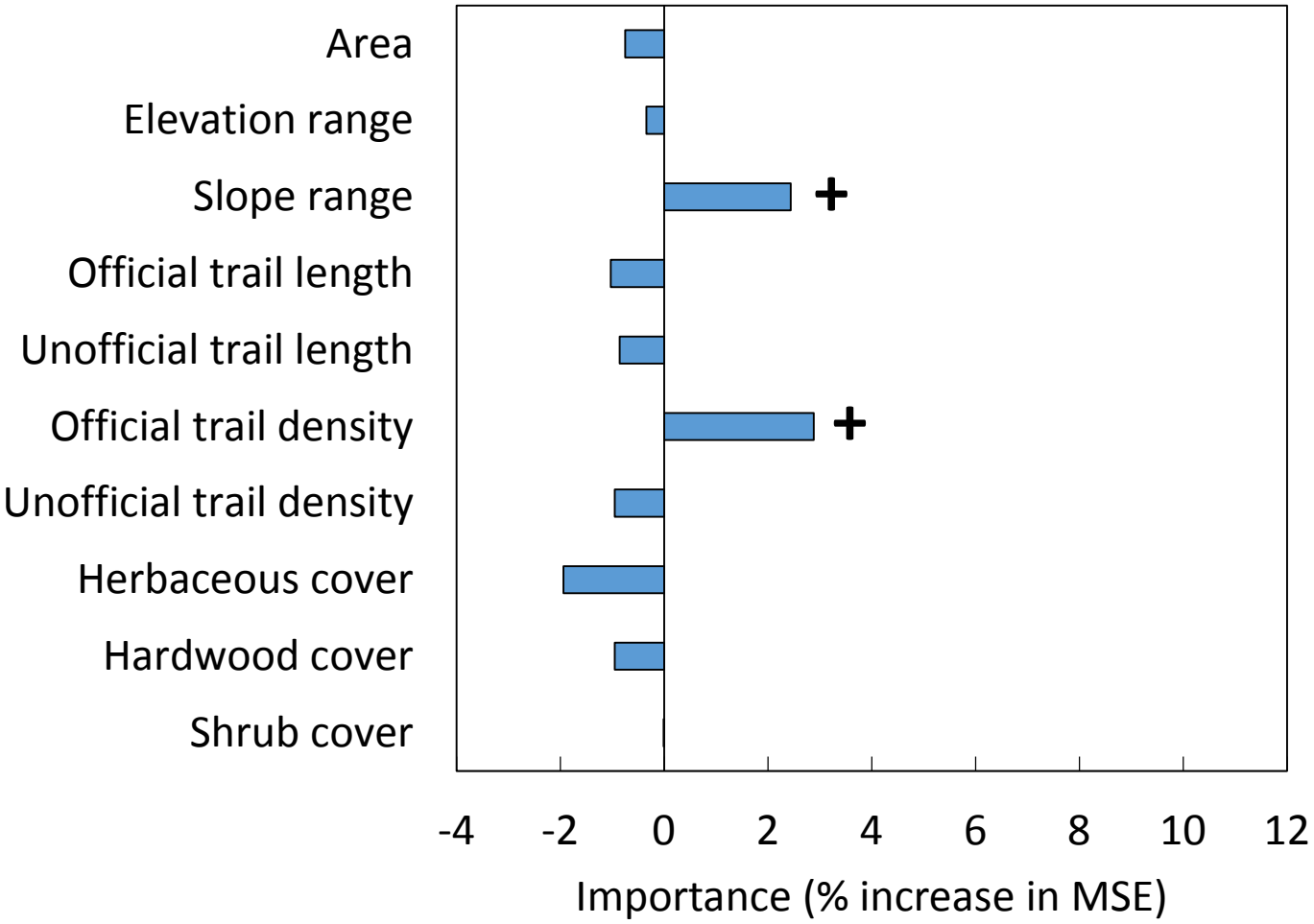
- Allow many, correlated predictors
- Identify important variables
- Make predictions



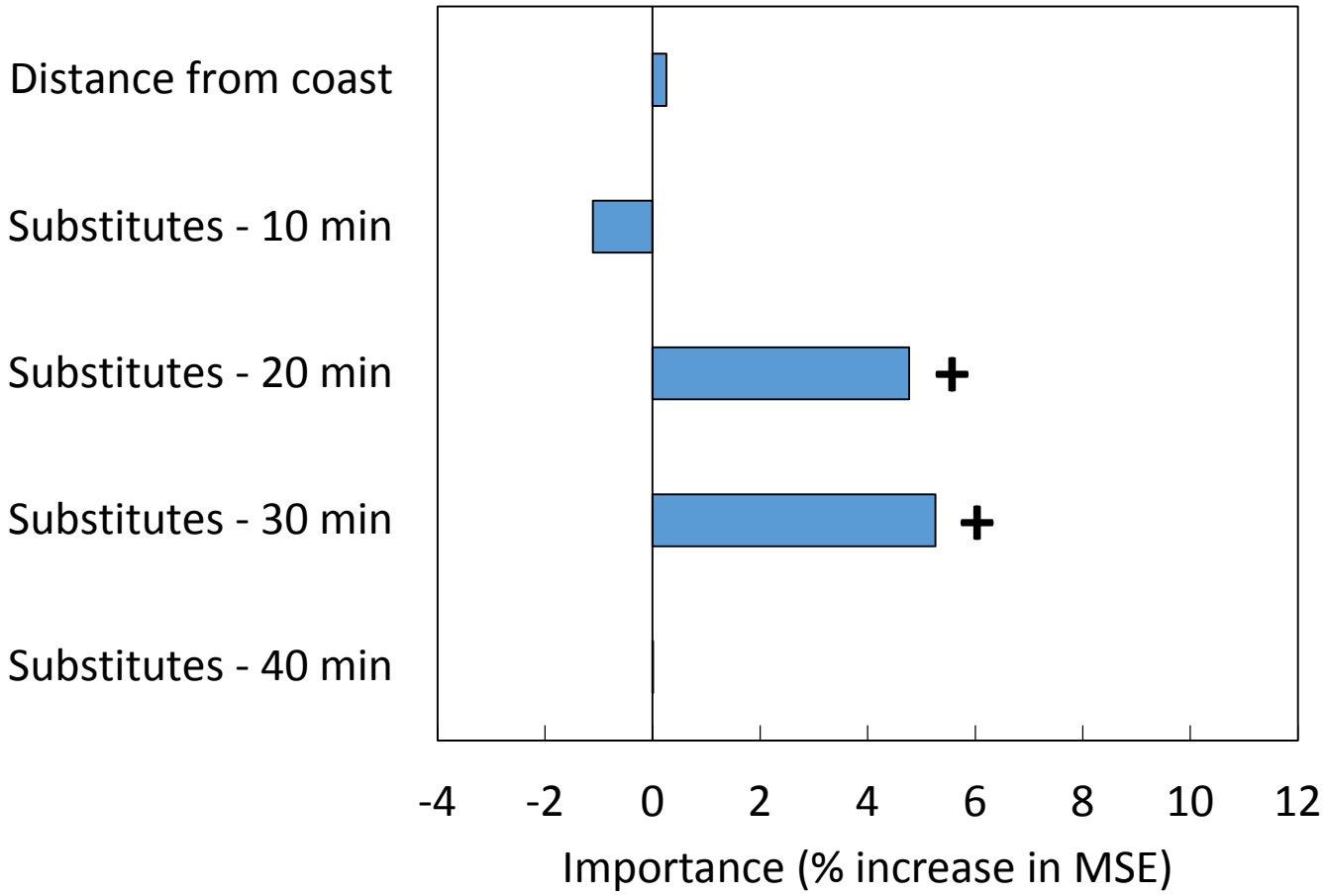
Variable importance: accessibility variables



Variable importance: reserve attributes



Variable importance: landscape context



Species exposure analysis

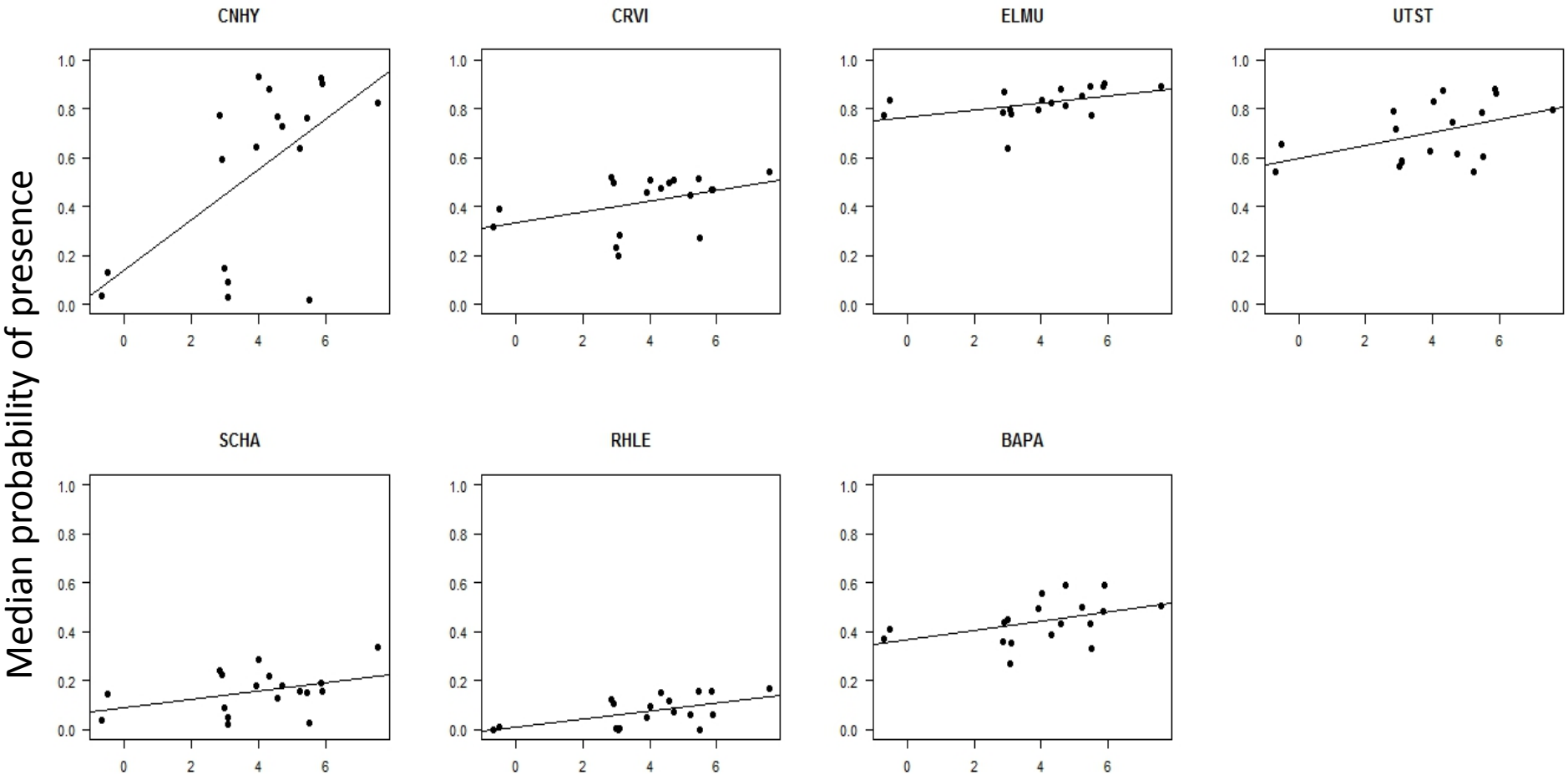
- 5 birds – Preston et al.

  - 2 covered on MSCP

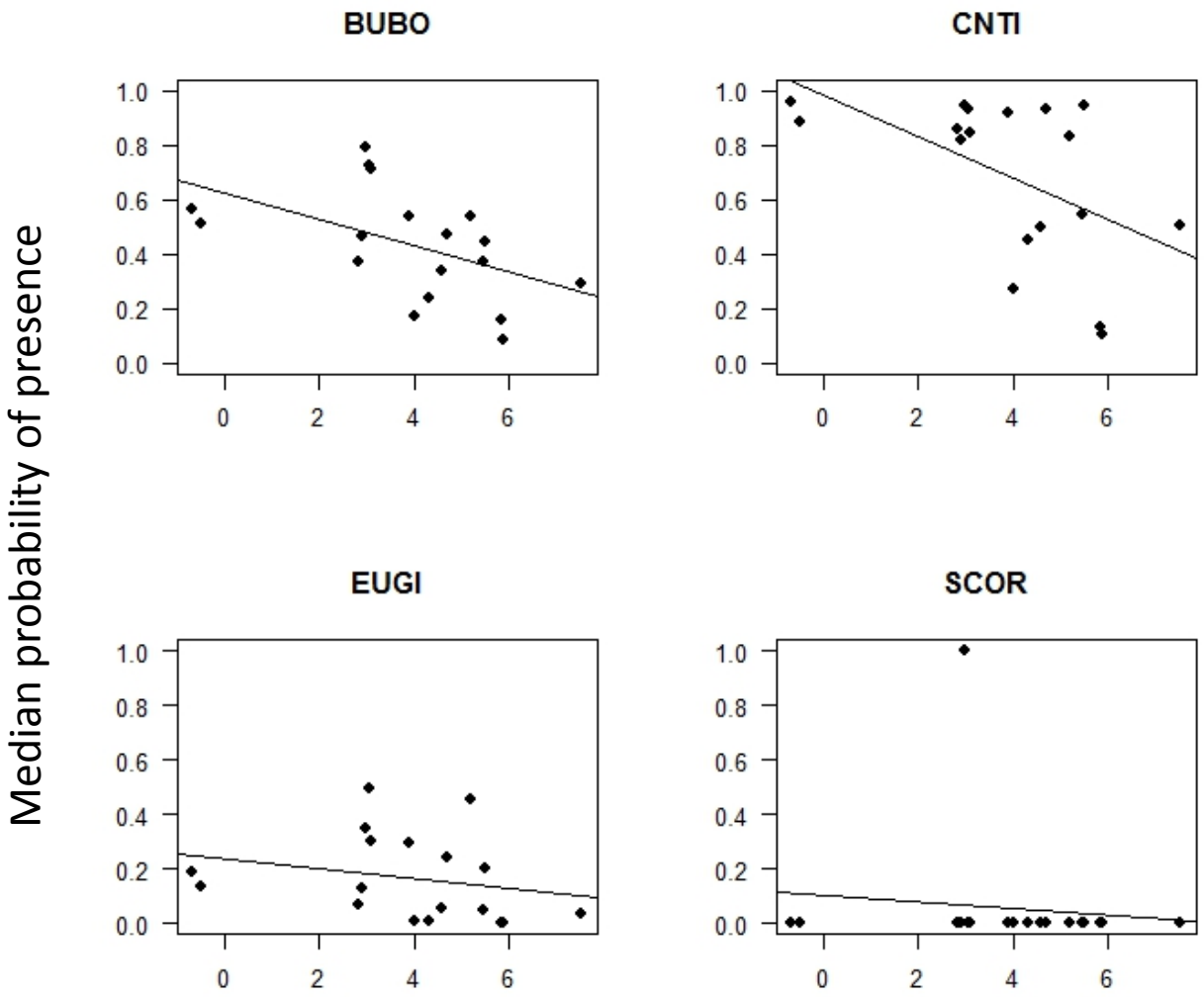
- 30 herps – Franklin et al.

  - 5 covered on MSCP

Some species are more exposed to recreation



...and others are less exposed to recreation



Summary of field study

- Wide variation in recreational use
- Accessibility, nearby reserves important drivers
- Model can be used to compare exposure

Questions?

Goals for Ph.D. project

1. Validate recreation model
2. Identify thresholds of human activity to which wildlife respond
3. Identify species that are particularly sensitive
4. Test effects of management alternatives (e.g. opening or closing trails)

Study taxa

Reptiles

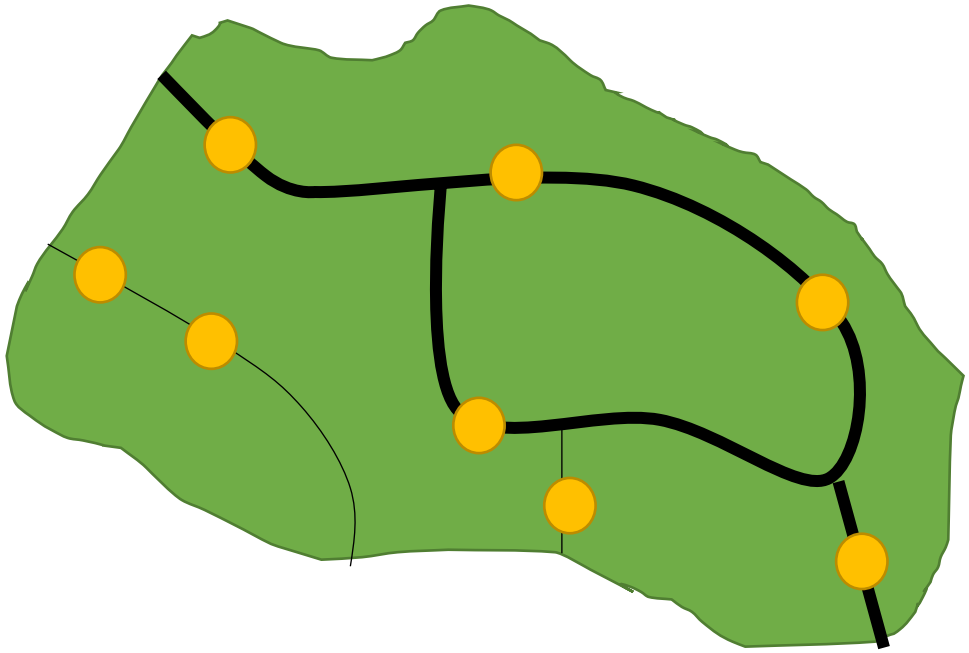
Mammals

Observational study

12 study sites

8 sampling points on trails within each site

Spatially-balanced random design to select points



Survey methods

Reptiles:

- Coverboards
- Visual encounter surveys

Mammals:

- Trail cameras

Humans:

- Trail cameras
- Citizen science approach

Ideas for experimental study

1. Use changes in the trail network for a BACI design.
   - New trails open
   - Trails are closed to public access
2. Conduct recreation ‘treatments’ using volunteers

Timeline

4 sampling periods during 1 year (fall 2015 to summer 2016)

- Cameras running for 1 month
- Coverboards checked every 2 weeks

Pilot study to test reptile sampling methods – summer 2015??

Feedback on Ph.D. research

1. Site selection: where should we work given target species/methods/questions?
2. Ideas for experimental approaches
   - Trail closures/openings?
   - Recreation treatments?
3. Reptile methods

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